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ABSTRACT

Results of a study made to determine the effect of male-female class ratio on female student class participation are reported. In spring 1980, an all-female section of an introductory math course was offered in addition to the other five mixed-sex sections at a midwestern university. It was found that women selecting the all-female section had lower math ability scores (SAT); yet, at the end of the course, these women attained higher achievement scores than women in the mixed-sex classes. Women in both groups had significant decreases in level of math-anxiety during the term, so that the greater achievement of the women in the all-female section could not be attributed to reduced level of math-anxiety. Also, returning women students--those over 25 and away from academia for at least 5 years--performed better in the all-female class. Finally, there was a lower withdrawal rate in the all-female section. Since the only difference between the all-female and mixed-sex sections was group gender, differences in class participation of women in the two environments were examined by an observer who sat in on each of the six sections to record student participation. The greatest participation was found to be in the all-female section, followed by the only mixed-sex class that had a female instructor, and an evening section with many returning students. (LP)

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INCREASING FEMALE PARTICIPATION IN THE MATHEMATICS CLASSROOM

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Introduction

Title IX of the Education Amendment of 1972 was intended to prevent educational discrimination on the basis of sex. Since the passage of Title IX, the number of women entering college has greatly increased. In fact, 1982 is the third year in a row which has seen the number of women enrolled in college exceed that of men (McCormick, 1982). But in spite of the fact that more women are entering college, there is still a low enrollment of women in what have been traditionally masculine fields, such as mathematics. It is this fact which concerns post-secondary educators.

Background

Marlaine Lockheed, a research sociologist, has challenged the implication that sex desegregation will bring about educational equity. She explains that the intention of Title IX is to ensure equity of educational benefits to males and females through integration of classrooms; however, integrating classrooms does not, in and of itself, guarantee equity of educational benefits. In fact, integrating the classroom may do as much harm as good (1976a, p.4). A recent report (Hall, 1982) issued by the Project on the Status and Education of Women (PSEW) supports Lockheed's claim. Hall suggests (pp. 1-2) that women students in mixed-sex classes may not experience the same educational benefits as men. She claims that the standard educational programs perpetuate the stereotypic differences between men and women in achievement. How then, do we change the educational setting to ensure that women not only have access to higher education but also experience educational opportunity at a level equal to that of their male colleagues?

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First, we need to look at the leadership patterns in mixed-sex groups. In her research on groups, Lockheed (1975) has consistently found that in "mixed-sex groups, men are more active than women, are more influential than women and are more task oriented than women" (p.2). She argues that leadership in mixed-sex groups is typically conceded to the males because both men and women expect males to be more competent at a task than females. According to Lockheed, this expectation is based on the relative value accorded men and women in society. Findings in Hall's report (1982, p. 8) support Lockheed's argument.

Lockheed used a game to study the female leadership patterns in single-sex and mixed-sex groups. In her study (1975, p. 6) Lockheed expected greater difference between the amount of activity exhibited in the game by males and females in naive mixed-sex groups than in experienced mixed-sex groups. Experienced groups were composed of individuals who had first played the game in a single-gender group. The results (1976b, p. 44) confirmed her expectations. This finding suggests that first experiencing, in groups of one's own gender, these activities which might occur in mixed-gender situations is a powerful treatment in itself. Lockheed (p. 60) goes on to recommend that as long as the curriculum is identical, math groups might initially be sex-segregated.

Procedure and Results

In Spring 1980, at a midwestern university, an all-female section of an introductory math course was offered in addition to the other five mixed-sex sections. It was found that women who selected the all-female section had lower math ability scores (SAT), yet at the end of the course these same women attained higher achievement scores than women in the mixed-sex classes. But women in both groups, single-sex and mixed-sex, had significant decreases in level of math-anxiety during the term, so that the greater achievement gained by women in the all-female section could not be attributed to reduced levels of math-anxiety. Also, returning women students (over twenty-five and away from the academic setting at least five years) performed better in the all-female class. And, finally, there was a lower withdrawal rate in the all-female section. It should be noted that there was no difference in class format for the all-female and mixed-sex sections; the only difference was group gender.

Discussion

Since group gender was the only difference in the classes, the obvious question, in view of Lockheed's work, concerns the difference in class participation for the women in the two groups. On three occasions during the semester, an observer sat in on each of the six sections to record student participation. Participation was defined by the number of volunteer responses (questions or answers) during class lecture. The table on the next page categorizes the data.

Class Participation—Total Responses (male and female)

First, the greatest number of total responses occurred in sections 3092, 3093 and 3106. In an attempt to understand this observation, let us consider the characteristics which distinguished these sections from the others. Section 3092 was the all-female class, and some of the comments made by women in this class offer some possible explanations of the greater classroom participation:

> I enjoyed being in the all-female section. I didn't feel inhibited to ask questions at all.
>
> This course is set up so well (that) it makes learning fun. It is the only class I have had that I feel totally at ease with the instructor. . . . I think it is helpful to have an all-female class. It relieves pressure.
>
> I think girls communicate better where there is an all-girl class.
>
> I thought that I'm not that good in math, I tend to be more shy. I feel really stupid, anyway—so that would just make it easier when you're around girls.
>
> I never felt intimidated in the section with men, but (in the all-female class there is a) more relaxed atmosphere and less overall tension.
>
> The women's section was good in meeting other females.

Although fear of competition with men was the reason many of these women chose the all-female section, it was not the sole reason. Some women selected this section to meet and interact with other women. Regardless of their reasons for choosing the all-

Record of In-Class Participation

Obsevation	Gender	Section	% Female	Total # Responses	% Female Responses
Observation 1	All-Female	(3092)	100	42	100
Feb. 11, 1980-	Mixed-Sex	(3100)	58	12	83
Feb. 13, 1980	Mixed-Sex	(3096)	48	24	38
	Mixed-Sex	(3094)	58	13	54
	Mixed-Sex	(3106)	47	62	81
Observation 2	All-Female	(3092)	100	66	100
March 3, 1980-	Mixed-Sex	(3100)	50	24	63
March 5, 1980	Mixed-Sex	(3096)	62	20	7
	Mixed-Sex	(3094)	65	41	85
	Mixed-Sex	(3093)	50	45	7
	Mixed-Sex	(3106)	42	35	94
Observation 3	All-Female	(3092)	100	14	100
March 31, 1980-	Mixed-Sex	(3100)	63	19	47
April 2, 1980	Mixed-Sex	(3096)	56	12	58
	Mixed-Sex	(3094)	67	20	85
	Mixed-Sex	(3093)	42	34	13
	Mixed-Sex	(3106)	50	29	100

female class, it seems reasonable, in light of their greater class participation, to expect greater achievement from these women, which indeed was the case.

Section 3093, also with high numbers of responses, was the only mixed-sex class which had a female instructor. This fact leads one to consider the possibility that female math instructors elicit greater classroom participation than male instructors. A 1973 study of coeducational junior high classrooms (Good, Sikes, and Borphy, pp. 77,84) found that classes taught by females seemed to be more relaxed, more discussion-oriented, and more active, with greater student willingness to initiate interactions. It is ironic, however, that most of the responses in this section were made by male students, even though the instructor was female. More will be said on this point later in this paper.

The third section with high numbers of responses was 3106—the only evening section. Many of the students in this section were returning adult students—students who had been away from the educational setting for several years. Perhaps these students, with their experiences in non-academic settings, were more eager to become involved in class discussions in order to apply abstract mathematical concepts to real-life situations.

Class Participation—Percentage Female Responses

Another interesting aspect of the data in the table is the percentage of the responses made by females. Aside from the all-female section (100% female responses), the highest percentage of female responses occurred in the evening section. As mentioned earlier, many of the students in this section were returning students. In particular, most of these returning students were women—women who were very active in class discussions. Perhaps women who are away from the academic setting for a long period of time are just more active when they return to the classroom. The sense of camaraderie these women felt, accidentally clustered together in the evening section, may have freed them to interact. This possible explanation originated from a comment made by a returning woman student during the first week of class:

> At registration, I told them I didn't want the women's section. But in my class there are so many young people. I thought maybe there would be more older women in this section.

Had this student known that there were several returning women in the evening section, she probably would have been just as willing, or maybe even more willing, to switch to the evening section. It appears that this woman, like the women who selected the all-female class, was in search of a section with students like herself—the same sex, the same age or having had a similar period of absence from the academic setting.

Another intriguing observation about percentage of female responses is that all of the mixed-sex sections having high levels of female participation (3100,3094, and 3106) were taught by males. And, ironically, the section having the lowest percentage of female responses (3093) was taught by a female, even though this section had the highest overall total numbers of responses—male and female. This occurrence leads one to ponder the effect of the interaction between sex-of-teacher/sex-of-student and group gender on classroom interaction patterns. Remarks from two women in the all-female section support the idea that sex-of-student/sex-of-teacher has an impact on participation patterns.

> Well, I just feel more at ease with female math teachers.
>
> I think it's easier to talk to females, overall, than the male teachers. Most of the male teachers were . . . not understanding enough.

But why, then, were the women more reticent in the only mixed-sex section taught by a female? Maybe they were subdued by the aggression of male students in the classroom —an aggression accentuated by the fact that this male-dominated subject area was being taught by a female.

Implications

In the present study, no final answers were found to these questions—only speculations. The answers lie in future research involving class participation patterns among women. According to Dale Spender in The Times Educational Supplement (Hall, 1982, p.7):

> In mixed-sex classrooms it is often extremely difficult for females to talk, and even more difficult for teachers to provide them with the opportunity. This is not because teachers are supremely sexist beings, but because they are governed by the same rules as everyone else.

When and how will we change these rules? In 1973, the Carnegie Commission on Higher Education (CCHE) recommended that "until women are better prepared psychologically to compete with men in the classroom, there is a case for experimentation with special sections for women in large introductory courses" (p.74). Perhaps these experimental all-female classes can provide a learning climate which will free women to become more confident in classroom interactions, thus giving them the experience they need for work in future mixed-sex groups, whether it be in classroom or in nonacademic settings.

The CCHE report goes on to say (p.78) that these courses should be presented within relevant existing departments, since the ultimate goal should be to provide equity of educational opportunity to women. Assuming that this is the ultimate goal, educators must, in addition to providing interim all-female math classes, also work within the framework of coeducation to bring about changes in the curriculum which will achieve equity of educational benefits for men and women. Until research uncovers these needed changes and they are implemented in the curriculum, coeducational mathematics classrooms will retain their chilly atmosphere for women.

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